Calculating Flow into a Lift Station - Answers

Problem #1

The first step is to find the volume of water in the cylinder. To do this, convert inches to feet.

$$= 6 \text{ inches} \times \frac{1 \text{ foot}}{12 \text{ inches}} = 0.50 \text{ feet}$$

= 14 ft + 0.50 ft = 14.5 ft rise in water level

= 0.785 x D x D x Height

= 0.785 x 27 ft x 27 ft x 14.5 ft

= 8,297.84 ft^3

Lastly, convert the volume of water to gallons:

$$= 8{,}297.84 \text{ ft}^3 \times \frac{7.48 \text{ gallons}}{1 \text{ ft}^3} = 62{,}067.87 \text{ gal}$$

Now that you have determined the volume of water in the lift pump, you want to calculate the number of minutes the pump ran to create that volume of water. To do this, convert hours to minutes. (Remember, there are 60 minutes in an hour.)

= 1 hour + 45 minutes

$$= 1 \text{ hour} \times \frac{60 \text{ min}}{1 \text{ hour}} + 45 \text{ min}$$

= 60 min + 45 min

= 105 minutes

Now you can calculate the flow rate.

$$= \frac{62{,}067.87 \text{ gallons}}{105 \text{ minutes}}$$

= 591.12 gallons per minute

Knowing the dimensions of your lift station is helpful. This is a quick way to see how fast the water is coming in.

Now you can determine when your lift station will overflow. First, find the remaining volume of the lift station. The water height is already at 14 ft, 6 in. So the new height is 65 ft – 14 ft, 6 in = 50 ft, 6 in.

$$= 6 \text{ inches} \times \frac{1 \text{ ft}}{12 \text{ inches}} = 0.50 \text{ ft}$$

= 0.785 x D x D x Height

= 0.785 x 27 ft x 27 ft x 50.50 ft

= 28,899.38 ft^3

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Convert this volume to gallons:

$$= 28{,}899.38 \text{ ft.}^3 \times \frac{7.48 \text{ gallons}}{1 \text{ ft}^3} = 216{,}167.39 \text{ gal}$$

Now calculate the time you have before the lift station overflows:

$$= \frac{216{,}167.39 \text{ gal}}{591.12 \text{ gal/min}}$$

= 365.7 minutes or 6.09 hours (divide 365.7 minutes by 60 minutes/hour)

Lastly, convert this decimal into actual minutes:

= 60 min X .09 = 5.4 minutes

= 6 hrs, 5 minutes

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Problem #2

The first step is to find the volume of water in the cylinder.

= 0.785 x D x D x Height

= 0.785 x 14 ft x 14 ft x 22 ft

= 3,384.92 ft^3

Lastly, convert the volume of water to gallons:

$$= 3{,}384.92\ ft^3 \times \frac{7.48\ \text{gallons}}{1\ ft^3} = 25{,}319.20\ \text{gal}$$

Now that you have determined the volume of water in the lift pump, you want to calculate the number of minutes the pump ran to create that volume of water. To do this, convert hours to minutes. (Remember, there are 60 minutes in an hour.)

= 4 hour + 6 min

$$= 4\ \text{hour} \times \frac{60\ \text{min}}{1\ \text{hour}} + 6\ \text{min}$$

= 240 min + 6 min

= 246 minutes

Now you can calculate the flow rate.

$$= \frac{25{,}319.20\ \text{gallons}}{246\ \text{minutes}}$$

= 102.92 gallons per minute

Knowing the dimensions of your lift station is helpful. This is a quick way to see how fast the water is coming in.

Now you can determine when your lift station will overflow. First, find the remaining volume of the lift station. The water height is already at 22 ft. So the new height is 33 ft – 22ft = 11 ft.

= 0.785 x D x D x Height

= 0.785 x 14 ft x 14 ft x 11 ft

= 1,692.46 ft^3

Convert this volume to gallons:

$$= 1{,}692.46\ ft.^3 \times \frac{7.48\ \text{gallons}}{1\ ft^3} = 12{,}659.60\ \text{gal}$$

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Now calculate the time you have before the lift station overflows:

$$= \frac{12{,}659.60 \text{ gal}}{102.92 \text{ gal/min}}$$

= 123 minutes or 2.05 hours (divide 123 minutes by 60 minutes/hour)

Lastly, convert this decimal into actual minutes:

= 60 min X .05 = 3 minutes

= 2 hrs 3 minutes